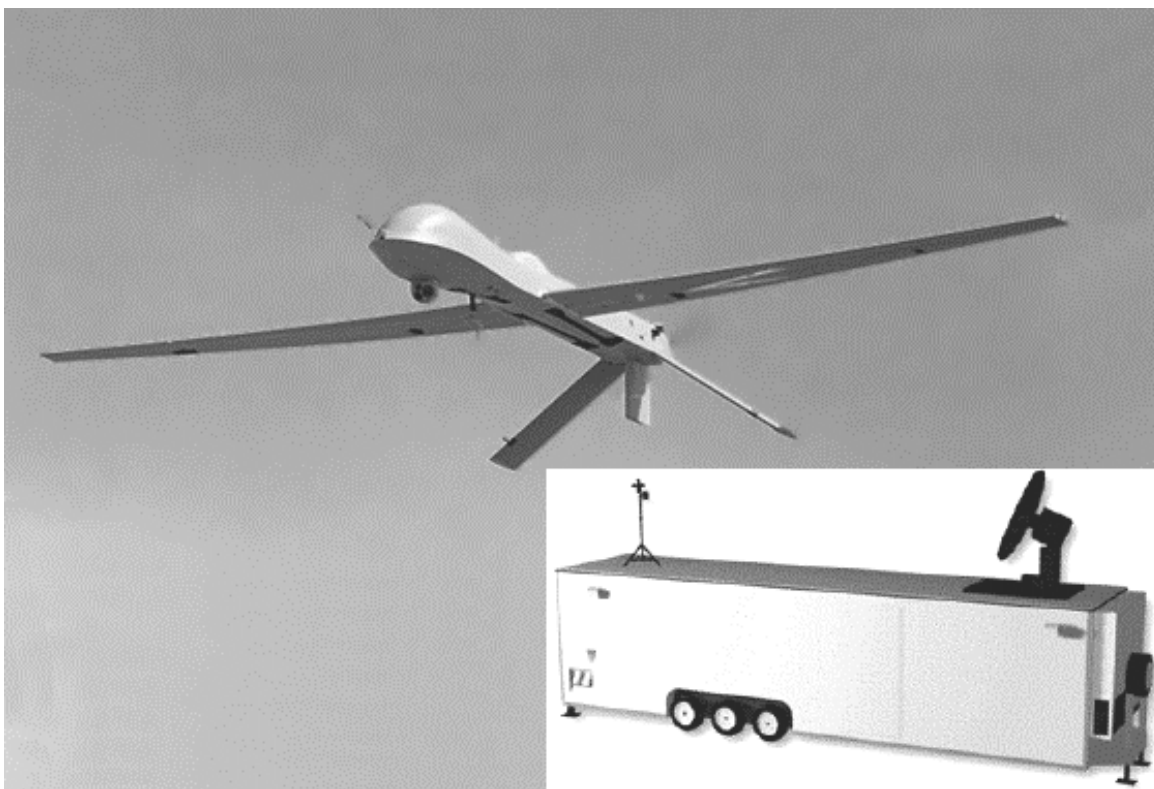


RQ-1A PREDATOR UNMANNED AERIAL VEHICLE (UAV) SYSTEM



Air Force ACAT ID Program

Total Number of Systems:	12
Total Program Cost (TY\$):	\$604.9M
Average Unit Cost (TY\$):	\$20.5M
Full-rate production:	1QFY00

Prime Contractor

General Atomics Aeronautical Systems, Inc.

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The mission of the medium altitude endurance unmanned aerial vehicle (UAV) system is to provide both cued and non-cued reconnaissance, surveillance, and targeting capability. The system can operate autonomously, is attritable (air vehicle cost is less than \$3.5 million), and does not compromise sensitive technology should it be lost over enemy territory. RQ-1A will help the in-theater Commander-in-Chief conduct *precision engagement* by helping provide *information superiority*.

The Predator system comprises both air and ground segments; it is intended to provide the Theater or Joint Task Force Commander with continuous imagery coverage of small, fixed, or mobile targets. The system will be required to operate in less than ideal weather conditions, and it can incorporate a wet-wing de-icing system to provide the capability to transit through moderate icing conditions.

The air segment consists of four propeller-driven full composite air vehicles with Electro-Optic, Infrared and Synthetic Aperture Radar sensor payloads. RQ-1A will fly at altitudes up to 25,000 feet Mean Sea Level. Data link systems between the air vehicle and the ground system include C-band, line-of-sight (LOS), and Ku-band satellite for operations beyond LOS.

The ground segment consists of a shelter containing the Ground Control Station (GCS) and a Predator Primary Satellite Link for imagery dissemination and satellite communications satellite communications (SATCOM) with the air vehicle. The typical crew in GCS comprises one air vehicle operator and one sensor operator per flight shift.

BACKGROUND INFORMATION

In August 1997, Predator completed its transition from an Advanced Concept Technology Demonstration (ACTD) to an ACAT II acquisition program. Five systems are residuals from ACTD, and subsequently, three production rate verification (PRV) contracts have been awarded, bringing the total number of systems delivered or under contract to eleven. A twelfth system is an option under the last PRV contract.

The Air Force Operational Requirements Document (ORD), approved in July 1997, delineated a number of system upgrades with the top priorities of a de-icing capability, a Ultra High Frequency (UHF)/Very High Frequency (VHF) radio link for air traffic control through the air vehicle, improved Identification-Friend-or-Foe (IFF) transponders, and repackaging of GCS. Other system capabilities defining the baseline system and intended to be included prior to operational test are the more powerful Rotax 914 engine, relief on station (ROS) capability, and reliability improvements. Predator system Number 6 will be the first system retrofitted with all baseline capabilities and is to be used for initial operational testing. U.S. Air Force 11th and 15th Reconnaissance Squadrons at Indian Springs Air Force Auxiliary Field, NV, currently operate Predator.

Testing and performance continue to be major issues. The dates for IOT&E have slipped because of late delivery of technical orders for the baseline system. A tentative date for IOT&E is October 2000. The impact on the program is unclear and testing may have little effect on development since all PRV contracts have already been awarded. The performance issues concern the ability of Predator to maintain 24-hour continuous coverage with ROS. The system contractor has demonstrated a ping-pong technique for controlling two airborne air vehicles, which permits operation in accordance with the ORD detailed time-on-station requirement. A proposed improved version of the ROS capability will be demonstrated to Air Combat Command in the second quarter of FY00 for consideration as a retrofit project. Further compounding the presence capability is the system's inherent reliability. Reliability, maintainability, and availability improvements were defined as part of the baseline upgrades from ACTD systems; however, no program has been defined by the program manager. Several action items were initiated after the April 1999 Defense Acquisition Executive Summary review, including development and implementation of an objective method to gather reliability data and the proposed method for ROS. These action items have not been resolved as of this writing.

Another major concern is configuration control. As the Predator system has transitioned from the ACTD phase into an Acquisition Program, the program has essentially built three different configurations of the Predator system with three different ground stations. Each configuration is unique and requires a separate set of technical orders, which include operation of the ground stations. The last of the configurations is the baseline operational system, which will be tested during IOT&E. All previous configured systems will eventually be upgraded to meet baseline requirements.

In March 1999, the Joint Requirements Oversight Council (JROC) issued guidance concerning Predator UAV and Tactical Control Station (TCS) interoperability. According to JROC Memorandum 034-99, Predator GCS is to incorporate TCS Level 2 (direct receipt of video from the air vehicle) interoperability with the Predator air vehicle. The JROC Memorandum also stated that TCS software used by the other Services is to provide up to Level 4 (full flight and payload control without takeoff and landing) interoperability with U.S. Air Force Predator UAV. Therefore, DOT&E will require the Air Force to demonstrate Level 2 functionality during Predator OT and the Army and Navy to include Level 4 TCS operations with U.S. Air Force Predator during their respective Tactical Unmanned Aerial Vehicle operational tests.

TEST & EVALUATION ACTIVITY

Technical tests and demonstrations continued this year at the contractor facility. These included UHF/VHF voice relay and Mode 4 IFF operation and control through C-band and LOS and Ku-band SATCOM data links, a turbo control unit (TCU) for the Rotax 914 equipped air vehicles, and a laser designator/infrared payload. Two different versions (contractors) of the same data link were installed and demonstrated. TCS demonstrated all levels of control except launch and recovery.

One Predator system was deployed to Kuwait for almost four months between January and April, and one air vehicle crashed during operations there. Three Predator systems were deployed to Bosnia in support of Operation Allied Force in Kosovo, including the first baseline-equipped system, Number 6. Four air vehicles were lost during those operations. AFOTEC prepared a data collection (an analysis plan for the deployed systems), but they were not allowed to travel in theater for direct observation of operations and verification of data collection. A great opportunity to collect operationally significant data was missed.

The AFOTEC-led Joint Reliability and Maintainability Evaluation Team (JRMET) continues to meet quarterly to consolidate reliability data collected from all operational and training systems.

TEST & EVALUATION ASSESSMENT

The UHF/VHF voice radio and Mode 4 IFF systems were successfully installed and deployed to theater on system Number 6. VHF range was weak and demonstrated only a 80- to 100-mile range (approx.) vice the 200-mile requirement. The TCU was also successfully installed and is now available on all Rotax 914 equipped air vehicles.

The deployment of system Number 6 to Kosovo was the first operational deployment of a baseline equipped system including the upgraded Rotax 914 engine, voice radio, IFF, and de-ice wings. With the transition of GCS to a new shelter, some problems were observed with transport aircraft loading and unloading and towing. Also, backup power and the communications panel were found deficient. Flight manuals were not formally validated prior to deployment, and three trained pilots provided comments and feedback for final technical orders. Overall, the operators were positive about system enhancements. Predator system Number 6 was modified with a laser designator system, the wartime implemented laser designator (WILD) to support Kosovo operations. Although the WILD equipped system was deployed to theater, it was never used in combat. There was general concern for the lack of proper training and employment/tactics to use the laser designator.

Data collected and scored by JRMET on four Predator systems indicate a system reliability ranging from 4.3 to 13.2 hours between critical failures. These low reliability numbers are clearly unacceptable for meeting continuous presence requirements. The Military Aircraft Sustainability Simulation (MASS), developed by DOT&E to predict effective time on station (ETOS) rates, predicts that the required 75 percent ETOS cannot be met even with ROS and 32-hours endurance (or greater) unless reliability is at least 20 hours mean time between critical failures. The ORD reliability requirement is 40 hours. The Air Force has stated that their standard reporting tools (CAMS/REMIS) make it difficult to track system-level Mean Time Between Critical Failures, and that these data may not be representative of actual system performance. However, no other data collection methods have been used to date. System Number 6 was typically tasked for a single mission per day of approximately 14 hours in length. Therefore, it did not have the opportunity to demonstrate an ability to provide 24-hour continuous coverage.

CONCLUSIONS, RECOMMENDATIONS, LESSONS LEARNED

Many initial glitches during the deployment packout and setup in theater could probably have been avoided if the system had been through rigorous operational testing prior to deployment.

The ability to collect system sustainability data over a long period of time; i.e., during operations, training, and technical testing, in addition to the relatively short period of time during OT, increases knowledge of system capabilities and helps reduce risk prior to IOT&E. However, there are concerns that the data for Predator systems are not being collected appropriately, thus diminishing the contribution to program development and risk reduction.

The use of sustainability data collected in the field, coupled with MASS simulation developed by DOT&E, provided insight not otherwise available for Predator's ETOS. Since ROS may not be operationally realistic for some time, the ETOS model can be used to predict the levels of target coverage expected with and without relief on station.